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ROYAL SOCIETY OF EDINBURGH.

1837. No. [illegible] 11.

Monday, 6th February 1837.

Sir THOMAS M. BRISBANE, Bart., President, in the Chair.

The following Donations were presented:

Bulletin de la Société Géologique de France. Tome vii. Feuilles 17–19.—*By the Society.*

Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences de France, (1er Semestre 1837). Nos. 1, 2, 3, 4.—*By the Academy.*

The American Journal of Science and Arts. Conducted by Benjamin Silliman, M.D., LL.D. Vol. xxxi. No. 1. for October 1836.—*By the Editor.*

Carte de la Côte Septentrionale d'Afrique entre Alger et les Iles Zafarines.

Plan de la Baie de Coquimbo—Plan de la rade d'Iquique.

Carte des Côtes de France, partie comprise entre le cap Fréhel et Caucale.

Carte des Côtes de France, (anse de Vauville, cap de la Hague), &c.

Carte des Côtes de France, (partie comprise le fort de Querqueville et le fort La Hague).

Carte des Côtes de France, (partie comprise entre la pointe de Barfleur et Grandchamp), &c.

Plan de Barfleur et de ses environs.

Plan de la rade de la Hongue.

Plan particulier de Mouillage d'Alger.

Par le Ministre de la Marine.

The following Communications were read:

1. On the Action of Disintegrated Surfaces of Crystals upon Light. By Sir D. Brewster.

In this paper the author commences with a summary of the present state of knowledge as to the internal constitution of crystalline bodies; and he then proceeds to describe the optical figures produced by the disintegrated surfaces of minerals and artificial minerals, according as the disintegration is effected—1. By the action of solvents while the crystal is forming, or remains in the bowels of the earth; 2. By the action of solvents on the surface of perfect crystals; and 3. By mechanical abrasion. The crystals of the first denomination he has examined are Brazil topaz, white fluor-spar, hornblende, axinite, boracite, oxidulated iron, dodecahedral garnet, diamond, and amethyst. The perfect crystals which he found best fitted for presenting the phenomena he describes are alum, fluor-spar, and calcareous spar. The facts related in this paper consist of a description of a great variety of optical appearances, of which it is impossible to give an abstract.

Date

2. Observations on the Pulsation of the Heart and Arteries. By Dr Knox.

The author here first describes briefly what has been done by previous physiologists towards determining the differences produced on the pulse by varieties in posture, by digestion, by age, by stature, by the period of the day, and by muscular motion. He then proceeds to relate the particulars of many new observations he has himself made upon these and other points connected with the circumstances which influence the rate of the heart's contractions. The general results are, that in his opinion the pulse is more frequent in the morning than at any other period of the day, abstracting the effect of stimuli; that the heart is more excitable at the same period; that the pulse is depressed by cold; that it is excited by muscular exertion, and more in the weak than in the strong, and also more by exercise carried to fatigue than by moderate exercise; that it is most frequent in the young, and least frequent in the old; and that great varieties are produced by differences in posture, those positions of the body occasioning the greatest excitement which require most muscular effort for their maintenance.

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Monday, 20th February 1837.

Dr ABERCROMBY, V. P., in the Chair.

The following gentlemen were elected Ordinary Fellows:

1. Richard Parnell, M. D.
2. Peter D. Handyside, M. D., Lecturer on Anatomy.

The following donations were presented:

Asiatic Researches; or Transactions of the Society instituted in Bengal for inquiring into the History, the Antiquities, the Arts and Sciences, and Literature of Asia. Vol. xx. Part 1.—*By the Society.*

The Journal of the Asiatic Society of Bengal for June and July 1836.—*By the Society.*

Mémoires de la Société de Physique et d'Histoire Naturelle de Genève. Tome vii. Partie 2.—*By the Society.*

Recherches sur la Cause de l'Electricité Voltaique. Par M. le Professeur Auguste De la Rive.—*By the Author.*

Report on the New Standard Scale of the Royal Astronomical Society. By Francis Baily, Esq. F.R.S. &c.—*By the Author.*

Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences de France, (1er Semestre 1837). Nos. 5. and 6.—*By the Academy.*

Brief Outlines illustrative of the Alterations in the House of Commons, in reference to the Acoustic and Ventilating Arrangements. By D. B. Reid, M.D., F.R.S.E.—*By the Author.*

The following communications were read:

1. On an Expression for the effort required to Ascend Planes of Different Inclinations. By Professor Forbes.

The author states that, whilst it has been pretty generally agreed by authors on animal mechanics that the measure of muscular effort is generally expressed by the weight multiplied by the *vertical* height through which it is raised, it is clear that this cannot be universally true, since, in the particular case of horizontal motion, no vertical height can be obtained; and, when the ascent is vertical, it is very unlikely that the same advantage of ascent should be obtained as at lower angles.

The author proposes, by a formula, to represent the length of path described by an average muscular effort at a given angular ascent in a given time, and which, multiplied by the sine of that angle, will give the vertical height gained.

Direct experiments are quoted, to shew the uniformity of vertical ascent within the usual limits, viz. between 12° and 25°. From the known results of tread-mill experiments, it is supposed that the diminution of effective action at a vertical ascent is not very considerable, but may yet amount to about 1100 feet per hour; whilst about 20°, the effective action, will be nearly 1500 feet per hour. The horizontal action is estimated at about four miles per hour. The following formula sufficiently represents extensive experiments at various angles of ascent, h = height ascended in English feet in an hour, at an angle α:—

$$h = \left\{ \frac{1900}{\sin.(\alpha + 5^\circ)} - 800 \sin.\alpha \right\} \sin.\alpha.$$

2. Observations on some New Species of British Fishes. By Dr Parnell.

The author stated that a species of sturgeon, for which he has proposed the name of *Acipenser latirostris*, as characteristic of the species, is occasionally met with in the Frith of Forth, in the Solway Frith and in the Tay. It is called by the fishermen the Broad-nosed Sturgeon, to distinguish it from the Acipenser sturio, or sharp-nosed species. The length, in general, seven feet; weight, about eight stone. The colour of the head, back, and sides, is of an olive-grey; the belly dirty white. The body is armed with five rows of osseous shields, extending from the head to the tail. The first row runs down the central ridge of the back. The two next rows arise one on each side of the former, and immediately on the lower margin of the pectorals the other two rows commence. The dorsal shields are but very slightly carinated, the fifth being the highest in the series.

The nose is broad and depressed, the point of which is larger than the diameter of the mouth. On the under surface of the snout are four cirri, situated much nearer the tip of the snout than to the upper lip. The central plates on the summit of the head are beautifully radiated, and of a fibrous appearance. The whole skin is rough, with a number of small angular osseous plates intermixed with very minute spicula. The position of the pectoral fins is the same as in other sturgeons.

This fish differs from the Acipenser sturio, the only other British species of sturgeon, in having the extremity of the snout much broader than the diameter of the mouth,—the keel of the dorsal plates but slightly elevated,—and the cirri situated much nearer to the tip of the nose than to the upper lip. For a representation of the head see the accompanying Plate. No. I.

Gobius unipunctatus. (Parnell.)

This species of Goby is common on the coast of Devon, rare in the Solway Frith, and occasionally met with in the Frith of Forth. It grows to three inches and a half in length. The back is of a reddish-brown crossed with a few short dark lines; the belly, ventral and anal fins, are of a pure white. The first dorsal fin is composed of six rays, the second of eleven rays, the last rays being shorter than the first. The tail is even at the end. Between the fifth and sixth ray of the first dorsal fin is a large dark spot which is always constant; from which circumstance the author has proposed the name of *unipunctatus.* This fish perhaps is nearer allied to the *Gobius minutus* than to any other; but the dark spot on the firstdorsal, and the tail being even at the end, will readily distinguish it.

Gobius albus. (Parnell.)

This fish, in the month of June, is common in the Solway Frith, and is evidently the fry of a large species. Its length is about two inches. The body nearly transparent; the head large; the gape wide; the teeth small and sharp, placed in one row in each jaw. The numbers of the fin rays are—first dorsal 5; second dorsal 13; ventral 13; anal 13; caudal 12. The terminating rays of the second dorsal and anal fins are the longest. The presence of only five rays in the first dorsal fin is sufficient to distinguish this fish from every other of the same genus.

The accompanying plate No. I. represents the two new species together with the other species of Gobius previously distinguished.

Dr Parnell at the same time exhibited several specimens of fishes hitherto unnoticed on the coast of Scotland.

Trigla Blochii (*Yarrell.*) Specific character.—A black spot on the first dorsal fin; the dorsal ridge and lateral line strongly serrated. Frequent. July.

Trigla Hirundo (*Yarr.*) Sp. ch.—Lateral line smooth, pectoral fins large, of a deep blue colour. Rare.

Cottus Bubalis (*Yarr.*) Sp. ch.—Preoperculum with four spines; lateral line rough. Common. July.

Gasterosteus trachurus (*Yarr.*) Sp. ch.--Lateral plates extending the whole length of the body. Frequent. July.

Gasterosteus semiarmatus (*Yarr.*) Sp. ch.—Lateral plates extending as far as the vent. Frequent. August.

Mugil chelo (*Yarr.*) Sp. ch.—Upper lip thick and fleshy. Common. July.

Pagellus centrodontus (*Yarr.*) Sp. ch.—Eyes large; a black spot at the origin of the lateral line. Rare. (See Plate II.)

Pagellus erythrinus (*Cuvier.*) Sp. ch.—Eyes rather small; lateral line and base of the pectorals without a spot. Rare. (See Plate II.)

Crenilabrus tinca (*Yarr.*) Sp. ch.—Caudal extremity of the body, plain. Frequent. June.

Crenilabrus Cornubicus (*Yarr.*) Sp. ch.—A black spot under the caudal extremity of the lateral line. Frequent. July.

Leuciscus dobula (*Yarr.*) Sp. ch.—Dorsal fin nine rays; lateral line fifty scales; middle ray of the tail more than half as long as the longest ray in the same fin; dorsal and anal fins even at the end. Common in the river Annan, Dumfries-shire.

Alosa finta (*Yarr.*) Sp. ch.—Teeth in both jaws; a row of spots along each side of the body. Frequent. July.

Alosa vulgaris (*Yarr.*) Sp. ch.—Jaws without teeth; sides without spots. Rare.

Pleuronectes hirtus (*Yarr.*) Sp. ch.—Under surface smooth; first dorsal ray not longer than the second. Rare.

Raia chagrinea (*Montagu.*) Sp. ch.—Tail with two rows of curved spines; back rough. Rare.

Raia radiata (*Yarr.*) Sp. ch.—Tail with three rows of spines; the spines forming the lateral rows three times as small and four times as numerous as those of the middle row. Frequent, April.

Ammocœtes branchialis (*Yarr.*) Sp. ch.—Mouth without teeth. Rare. Frith of Forth above Stirling.

3. Dr Macdonald gave an account of a proposed improved system of chemical nomenclature.

Monday, 6th March 1837.

Sir THOMAS M. BRISBANE, Bart., President, in the Chair.

The following Donations were presented:

The Journal of the Asiatic Society of Bengal for August 1836.—*By the Society.*

Transactions of the Zoological Society of London.—Vol. ii. Part 1. *By the Society.*

Statuti dell' Accademia di Palermo.—*By the Academy.*

De Redigendis ad unicam seriem comparabilem Meteorologicis ubique factis observationibus conventio proposita, et Tabulæ supputatæ, ab equite Nicolao Cacciatore, Regii Observatorii Panormitani Directore.

Considerations regarding the Edinburgh, Leith, and Newhaven Railway. By Patrick Neill, LL. D., F. R. S. E.—*By the Author.*

Specimen of a Treatise on the Differential Calculus or Fluxions; founded on an original principle derived from the Ancient Geometry. By the Rev. John Forbes, Minister of St Paul's, Glasgow.—*By the Author.*

The Quarterly Journal of Agriculture; and the Prize Essays and Transactions of the Highland and Agricultural Society of Scotland. No. 36, March 1837.—*By the Society.*

Transactions of the Society instituted at London for the Encouragement of Arts, Manufactures, and Commerce. Vol. li. Part 1. —*By the Society.*

Two Essays on the Geography of Ancient Asia; intended partly to illustrate the Campaigns of Alexander, and the Anabasis of Xenophon. By the Rev. John Williams, Vicar of Lampeter, and Rector of the Edinburgh Academy.—*By the Author.*

The following communications were read:— D Eh

1. On the power of the Periosteum to form new bone. By Professor Syme.

The object of the author in this paper is to state certain observations and experiments by which he considers it to be clearly established, that the periosteal membrane, covering the bones, has the power of secreting osseous substance and of forming new bony matter.

Duhamel, founding on a false analogy, which he supposed to exist between the periosteum and the bone on the one hand, and the bark and wood of trees on the other, was the first to lay down distinctly the theory that bony matter is formed by the investing membrane of the bones. The experiments and observations of *Haller* and others on the progress of ossification in young animals were believed, however, to militate against this idea, and tended rather to establish the doctrine, that new bony matter is formed by the pre-existing or old bone. Between these two theories, the opinions of physiologists and surgeons are still pretty equally divided.

The author was lately induced to suspect, from the circumstances of a case of necrosis, that the theory of Duhamel is the true one. In a case of inflammation of the tibia consequent on an injury and terminating in death, of nearly the whole of that bone, amputation became necessary at the close of five weeks after the accident. On examining the amputated limb, the periosteum of the tibia was found chequered with patches of osseous substance adhering to its inner surface, and covered with a delicate membrane. This observation led him to subject the question to the test of experiment, which he conceives he has accomplished in the following manner. An incision was made in the fore leg of a dog, and a portion of the radius, about two inches long, was removed along with its investing membrane. In the other fore leg the same operation was performed, with the exception that the periosteum was carefully dissected from the portion of bone which it was intended to remove, and two inches of bone were cut out, its membrane being thus left entire. In six weeks the animal was killed; when it was found that a large vacuity was left in the radius, where the membrane was removed as well as the portion of bone; while in the other, where the membrane had been left, the gap was entirely filled up by firm osseous texture, and at this part of the radius the bone was even thicker than elsewhere. The experiment was several times repeated with the same result. In another dog the periosteum of the radius was carefully dissected off as before, but without either disturbing the position of the membrane or removing the subjacent portion of bone; and a thin metallic plate was passed around the bone between it and the detached periosteum. In six week the animal was killed and the limb examined. The inner surface of the membrane presented an extensive deposition of osseous matter between it and the metallic plate; while between the plate and the bone there was merely a membranous formation without any new bony substance whatever.

2. On one Troja. By the Venerable Archdeacon Williams.

The introduction only of this communication was read. The abstract will be given after the paper is concluded.

Monday, 20th March 1837.

Sir THOMAS M. BRISBANE, Bart., President, in the Chair.

The following Donations were presented:

Mémoire sur l'Instruction secondaire dans le Royaume de Prusse. Par M. V. Cousin, Directeur de l'Ecole Normale.—*By the Author.*

The Journal of the Royal Asiatic Society of Great Britain and Ireland. No. 2 (November 1834).

Transactions of the Royal Asiatic Society of Great Britain and Ireland. Vol. ii. Part 1.—*By the Society.*

Transactions of the Horticultural Society of London (second series). Vol. i. and Vol. ii. Parts 1, 2.—*By the Society.*

Table des Positions Géographiques des Principaux Lieux du Globe. Par M. Daussy.

Sur l'Influence de la Pression Atmosphérique sur le Niveau moyen de la Mer. Par M. Daussy.—*By the Author.*

Novorum Actorum Academiæ Cæsareæ Leopoldino-Carolinæ Naturæ Curiosorum Voluminis Septimi Decimi Supplementum.—*By the Academy.*

Transactions of the Institute of British Architects of London, Session 1835–36. Vol. i. Part 1.—*By the Institute.*

The Anatomy, Particular and Surgical, of the Human Body, illustrated by a series of Engravings. By A. Fyfe, F. R. C. S. E. Corrected and arranged, and with an Explanatory Letter-Press, by P. D. Handyside, M. D., &c. Part 1.—*By Dr Handyside.*

An Elementary Introduction to Mineralogy; comprising a Notice of the Characters and Elements of Minerals. By William

Phillips, F. L. S., M. G. S. L. and C. Considerably augmented by Robert Allan, F. R. S. E., M. G. S. L., &c.—*By Robert Allan, Esq.*

The following communication was read:

On the Action of Voltaic Electricity or Pyroxylic Spirit, and on Solutions in Water, Alcohol, and Ether. By Arthur Connell, Esq.

The author has found a perfect resemblance to exist between the appearances presented by pyroxylic spirit (Bihydrate of Methyline of Dumas and Peligot) under voltaic agency, and those which he had previously observed in regard to alcohol; a coincidence which was to be expected, from the interesting analogy existing between these two liquids in other respects.

The pyroxylic spirit, after three distillations from quicklime, had a specific gravity of 801 at 62° F., and boiled in contact with mercury at 140° F., under a pressure of 29.5 inches. The leading facts observed were the following:—

Minute quantities of acid, alkaline, and saline bodies, when dissolved with rectified pyroxylic spirit, favoured the voltaic action, by increasing the conducting power of the liquid. When it held in solution $\frac{1}{350}$ of pure potash, and was submitted to the agency of thirty-six pairs of four-inch plates in a tube with parallel platinum foil poles, hydrogen was given off from the negative pole, while no gas proceeded from the positive pole. A ten thousandth part of potash had a marked effect in promoting this action.

When the pure spirit was submitted in a similar tube to the agency of seventy-two pairs of four-inch plates, hydrogen was in like manner evolved, although in smaller quantity.

When the same electric current was passed through the spirit and through water, each holding dissolved $\frac{1}{500}$ part of potash, the quantity of hydrogen evolved from both negative poles was the same.

Besides the evolution of elastic fluid, there were found in the liquid acted on small quantities of such substances as often result from the oxidation of analogous liquids, such as resinous matter; and, where the quantity of dissolved potash was considerable, a speedy precipitation of carbonate of potash ensued, the liquid at the same time acquiring a red colour from the formation of resinous matter.

In the whole circumstances it was concluded, as had been done

in regard to alcohol, that water, entering as such into the constitution of pyroxylic spirit, is resolved under voltaic agency into its elements, its hydrogen being evolved at the negative pole, and its oxygen employed in giving rise to the secondary effects of oxidation.

As pyroxylic ether (hydrate of methyline of D. and P.) bears the gaseous form, no galvanic experiments were attempted with it; but, as the author had formerly observed no evidence of the presence of water in sulphuric ether under electric agency, he is disposed to adopt the analogous view as in regard to alcohol, and to consider pyroxylic spirit as a hydrate of pyroxylic ether, which latter substance, like sulphuric ether, he regards not as an oxide, but simply as a ternary combination of its constituents.

The results formerly stated to the Society in proof of the secondary origin of chlorine or iodine, when aqueous solutions of the corresponding hydracids and haloid salts are submitted to voltaic agency, have been confirmed with stronger voltaic powers, the only difference being, that the chlorine or iodine, and also the corresponding hydracid, from the secondary decomposition of which, by nascent oxygen, the chlorine or iodine proceeds, are sooner carried over from the negatively electrified solution into the positively electrified water, than when smaller powers are employed. The Bromide decomposition of [redacted] of iodine in an aqueous solution of starch, has also been ascertained, by analogous methods, to be a secondary action.

The appearances presented during the electric decomposition of alcoholic solutions of acids, alkalies, and salts, have been found to be very analogous to those observed in the corresponding aqueous solutions, the principal difference being, that the oxygen of the decomposed water of the alcohol rarely appears at the positive pole, for reasons formerly explained. An ordinary oxyacid salt dissolved in alcohol is slowly resolved, under voltaic action, into its constituent acid and base, with evolution of hydrogen at the negative pole; and, where the base is not of difficult reduction, a portion of it is reduced by the hydrogen. By experiments conducted on principles exactly analogous to those with aqueous solutions, it was found that the appearance of iodine at the positive pole, in an alcoholic solution of iodide of potassium, is a secondary effect due to nascent oxygen.

By instituting a comparison between the electric action on alcoholic and on aqueous solutions of chlorides and iodides, under circumstances in which no secondary actions could take place at the poles, the appearances led to the conclusion, that these salts are not dissolved as such in water, but as muriates and hydriodates. The solution was placed in a tube connected by means of asbestus with two other tubes containing distilled water, the positive pole being introduced into one of the tubes containing water, and the negative into the other. When an alcoholic solution of a chloride or iodide iddle was in the [illegible] tube, no acid was observed to be produced in the alcoholic solution, but only at the point of contact between the solution and the water. On the other hand, when an aqueous solution was employed, a plentiful production of the corresponding hydracid was observed in that solution on its positive side. These appearances are exactly those which ought to be observed, if we suppose chlorides and iodides to be dissolved as such in absolute alcohol, and as muriates and hydriodates in water. In none of these cases was chlorine or iodine produced, except at the positive pole in the positive water, by a secondary action on the corresponding hydracid.

When etherial solutions of various substances, such as potash, chromic acid, and metallic chlorides, are submitted to galvanic action, there is no symptom of decomposition either of the solvent or of the dissolved body. Thus no exception has yet been met with to the general conclusion, "That when solutions of binary combinations of elementary bodies in water, alcohol, or ether, are submitted to voltaic agency, the dissolved substance is not decomposed, but only the solvent, if itself an electrolyte." A few cases, however, comprehended within the law still remain to be experimentally investigated.

Sir Charles Bell gave a Verbal Notice regarding the importance of the Circulation in the Medulla Oblongata, and the office of the Vertebral Artery.

Monday, 3d April 1837.

The Right Honourable **LORD GREENOCK**, Vice-President in the Chair.

The following Donations were presented :

Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences (1837, 1er Semestre), Nos. 7, 8, 9, 10, 11.—*By the Academy.*

Annalen der Physik und Chemie. Herausgegeben zu Berlin, von J. C. Poggendorff. 1836. Nos. 10, 11, 12.—*By the Editor.*

On the Arenarius of Archimedes. By S. P. Rigaud, M. A., Savilian Professor of Astronomy.—*By the Author.*

A Catalogue of the Collection of British Quadrupeds in the Museum of the Cambridge Philosophical Society.

Transactions of the Cambridge Philosophical Society. Vol. vi. Part 1.—*By the Society.*

Supplement to the Account of the Rev. John Flamsteed, the first Astronomer-Royal. By Francis Baily, Esq. F. R. S., &c.—*By the Author.*

On the Theory of the Moon, and on the Perturbations of the Planets. By J. W. Lubbock, Esq., F. R. R. A. and L. S. S.—*By the Author.*

Report of the Fifth Meeting of the British Association for the Advancement of Science, held at Dublin in 1835.—*By the British Association.*

Discussion of the Magnetical Observations made by Captain Back, R. N., during his late Arctic Expedition. By S. Hunter Christie, Esq., M. A., F. R. S., &c.—*By the Author.*

List of the Fellows of the Royal Society (1836).

Addresses delivered at the Anniversary Meetings of the Royal Society on Saturday, November 30. 1833, and on Wednesday, November 30. 1836, by His Royal Highness, the Duke of Sussex, K. G., &c. &c. &c., the President.

Proceedings of the Royal Society. Nos. 19 to 27.

Philosophical Transactions of the Royal Society of London for the year 1836. Part 2.—*By the Society.*

Astronomical Observations made at the Royal Observatory at Greenwich, 1834, Parts 4 and 5, and 1835, Parts 1, 2, 3, 4, 5, under the direction of John Pond, Esq., Astronomer-Royal.—*By the Royal Society.*

The following communications were read—

1. Geological Observations on Binny-Crag in West-Lothian, by Charles Maclaren, Esq.

Binny Crag in West Lothian is of compact greenstone, about half a mile in length, and from twenty to one hundred and forty feet in breadth. It extends south and north, and has a small ravine on its west side, above which the highest part of the crag rises about two hundred feet. Three phenomena connected with this crag are worthy of observation. 1. *It has the character of a trap vein which has ruptured the strata in a fluid state.* The dip of the sedimentary rocks on its west side is to west-south-west, on the east side to the east, and in both cases at a pretty high angle. We have here, therefore, evidence of the strata having been ruptured, and a fissure formed; and we have the trap, the rupturing agent, placed on the fissure, and occupying the anticlinal line, or axis of the upheaving movement. According to the received hypothesis respecting the origin of trap, we might expect this appearance to be common, and yet it is rather rare. It forms the exception, while it ought apparently to be the rule. 2. *The trap has mingled with the shale, and affected its structure in a very remarkable manner.* It has enveloped portions of the shale within its mass, and penetrated laterally among the beds to the extent of one hundred feet or more on the east side. On the south flank of the highest part of the crag we have a section exhibiting the relations of the two rocks. The trap has the form of an arch, of perhaps twenty feet radius, with a long straight tabular mass about three feet farther to the east. A mass of shale lies under the arch exhibiting a laminar structure; in the portions contiguous to the trap, its substance is hardened, and the planes of the laminæ, instead of being straight and parallel, are arranged concentrically with the curved surface of the trap which covers them. Portions of shale also lie under and above the thin tabular projecting mass of trap, and these likewise conform themselves to its surface. The inference is, that, independently of the original slaty form of the shale, a secondary laminar structure was induced upon it, by the heat of the fused trap being propagated through it progressively and unequally, each portion as it was dried and hardened, separating from that beyond it. 3. *The crag exhibits a striking example of the effects of denudation.* The north end of the ridge, which is low, and on a level with the surface of the land westward, has merely had its covering of shale stripped off, and exhibits a few trifling indentations; but the south end, which rises in bold relief above the adjacent land, has been cut into seven distinct hillocks, separated by transverse ravines, which are steep in the sides, and from ten to sixty feet in depth. The appearance of these ravines shews, that they must have been cut by powerful currents flowing from the west.

Date

2. Notice of Experimental Researches into the Laws of certain Hydrodynamical Phenomena that have not hitherto been reduced into Conformity with known Laws. By John Scott Russell, Esq. Lecturer on Natural Philosophy.

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This Paper contained the results of researches in hydrodynamics extending over a period of two years, and which the author is continuing to prosecute under the auspices of the British Association in conjunction with Mr Robison, the Secretary of this Society. The present paper contained the development of two new laws in hydrodynamics, which appeared of sufficient importance to form a paper by themselves.

These two laws are,

1. The Law of Emergence—as an Element of Resistance.
2. The Law of the Wave—as an Element of Resistance.

The state of our knowledge in hydrodynamics is well known to be very imperfect in comparison with the other departments of Natural Philosophy. Mr Challis, in his Report to the British Association on the present state of hydrodynamics, remarks, that his review may serve to shew that this department of science is in an extremely imperfect state, and that possibly it may on that account be the more likely to receive improvement; and he adds, that a singular fact relating to the resistance of bodies, partly immersed in water, has been observed, viz. that a boat drawn on a canal with a velocity of more than four or five miles an hour rises perceptibly out of the water, making the resistance less than if no such effect took place; and he further observes, that though theory never predicted any thing of that kind, it may probably soon be able to account for it on known mechanical principles. Professor Whewell makes the same avowal, and the Institute of France have made it the subject of their prize for three years without having obtained a solution of the difficulties with which this part of Natural Philosophy is beset.

There is one law well established by the labours of Newton, Bernoulli, Euler, D'Alembert, and their followers, that the resistance of a fluid to a body moving in it is proportioned to the square of the velocity.

This law holds in a great variety of instances, for vessels or objects wholly immersed in the fluid.

The law of the square of the velocity does not hold except in a few instances, and in peculiar circumstances, as regards resistance of fluids to the motion of floating bodies. If the water be not very deep, and if the velocity be more than three or four miles an hour, the deviation will become exceedingly striking. The following are causes of the deviation :

I. An EMERGENCE of the floating body from the fluid takes place at all velocities. This emergence is produced by the velocity of the body. When at rest the body, in virtue of the force of gravitation, displaces a portion of fluid equal to its own weight; but if it be moved it will require to displace a greater and greater portion of fluid in a given time. Now the force of gravity acting downwards on the body is constant force, and the force with which the fluid must be displaced is an increasing one; by comparing these two quantities together the following result is obtained—

$$R = s\, v^2 \left\{ 1 - \frac{v}{2g} \right\} \frac{\varrho}{2g}$$

Where R is the resistance, s the transverse section of statical displacement, v the velocity of the body, g the measure of gravity, and ϱ the density of the fluid, and by differentiating we find R a maximum, when $r = \frac{4g}{3}$ and the immersion $= 0$ when $v = 2g$.

II. The WAVE of the fluid interferes with the resistance. Those portions of a fluid which are thrown aside by the prow of a vessel form Waves. These waves are propagated in the direction of the motion of the vessel.

The wave of a fluid moves with a velocity which is nearly uniform.

The velocity of the wave is dependent solely upon the depth of the fluid, reckoning from the summit of the wave. It is quite independent of the width of the channel. It is quite independent of the velocity of the vessel which creates the waves. The velocity of the wave is equal to that which would be acquired by a body falling freely by gravity through a space equal to half the depth of the fluid.

The resistance of a fluid at a given velocity is intimately connected with the velocity of the wave in the fluid.

When the velocity of the floating body is less than that of the wave, the effect of the wave is to increase the resistance of the fluid.

When the velocity of the floating body is greater than that of the wave, the effect of the wave is to diminish the resistance of the fluid.

The manner in which the wave increases the resistance opposed to a fluid, is by increasing the immersion of the anterior part of the solid, by raising the front and leaving the stern depressed in the hollow behind the wave, so that the transverse section of resistance has an increment of area in the ratio of the rise of the elevation.

The manner in which the wave diminishes the resistance at velocities not less than that of the wave, is by falling behind the stern, so as to raise a portion of the vessel equal to itself above the mean level of the fluid, thus diminishing the anterior section presented to the vessel.

At all velocities greater than that of the wave, the displaced fluid falls behind the prow, and forms a compound wave, on the ridge of which the vessel is carried along with diminished anterior immersion.

These doctrines receive illustration from the navigation of shallow rivers and canals, and are applicable to the improvement of inland transport by water.

Monday, 17*th April* 1837.

Sir HENRY JARDINE in the Chair.

The following Donations were presented:

Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences (1837, 1er Semestre), Nos. 12 and 13.—*By the Academy.*

Bulletin de l'Académie Royale des Sciences et Belles Lettres de Bruxelles. Années 1832, 1834, 1835, Nos. 4, 5, 6, 7; and 1836, Nos. 8 and 12.

Essai Historique sur la Vie et la Doctrine d'Ammonius-Saccas, chef d'une des plus célèbres Ecoles Philosophiques de l'Alexandrie Par L. J. Dehaut.

Mémoire sur les Propriétés et l'Analyse de la Phloridzine. Par. L. de Koninck.

Annuaire de l'Observatoire de Bruxelles pour l'an 1837, par le Directeur A. Quetelet.

Annuaire de l'Académie Royale des Sciences et Belles Lettres de Bruxelles.—*By the Royal Academy.*

Sur la Latitude de l'Observatoire de Bruxelles. Par A. Quetelet, Directeur de cet Etablissement, &c.—*By the Author.*

Bulletin de la Société de Géographique (Deuxieme Serie), Tome vi. *By the Society.*

Astronomische Nachrichten. Nos. 312–322.—*By Professor Schumacher.*

Ueber die Kessels'schen Chronometer von Hansen.—*By the Author.*

Astronomische Beobachtungen auf der Königlichen Universitäts Sternwarte in Konigsberg. Von F. W. Bessel.—*By the Author.*

Arsberättelser om Vetenskapernas Framsteg, af gifne af Kongl. Vetenskaps-Academiens Embetsmän, d' 31 Mars 1835.

Kongl. Vetenskaps-Academiens Handlingar, för är 1835.—*By the Academy.*

Account of some Experiments made in different parts of Europe on Terrestrial Magnetic Intensity. By James D. Forbes, Esq., F. R. SS. L. and E., &c.—*By the Author.*

A large collection of Preserved Fishes was also presented by Dr Parnell. The following is a list of what have been presented by the same gentleman on this and on some prior occasions:

Perca fluviatilis, *Yarrel.*
Labrax lupus, *Yarr.*
Trachinus draco, *Yarr.*
Trachinus vipera, *Yarr.*
5 Trigla cuculus, *Yarr.*
Trigla lucerna, *Cuvier.*
Trigla gurnardus, *Yarr.*
Cottus scorpius, *Yarr.*
Cottus bubalis, *Yarr.*
10 Gasterosteus leiurus, *Yarr.*
Gasterosteus spinachia, *Yarr.*
Pagellus acarne, *Cuvier.*
Pagellus centrodontus, *Yarr.*
Scomber scomber, *Yarr.*
15 Caranx trachurus, *Yarr.*
Cantharus griseus, *Yarr.*
Zeus faber, *Yarr.*
Mugil chelo, *Yarr.*
Atherina presbyter, *Yarr.*
20 Blennius gattorugine, *Yarr.*
Muranoides guttata, *Yarr.*
Anarrhichas lupus, *Yarr.*
Gobius niger, (in spt.) *Yarr.*
Gobius minutus, (in spt.) *Yarr.*
25 Gobius unipunctatus, (in spt.) *Parnell.*
Gobius bipunctatus, in spt.) *Yarr.*
Gobius gracilis, (in spt.) *Yarr.*
Gobius albus, (in spt.) *Parnell.*
Callionymus lyra, *Yarr.*
30 Callionymus dracunculus, *Yarr.*
Lophius piscatorius, *Yarr.*
Labrus maculatus, *Yarr.*
Crenilabrus tinca, *Yarr.*

Crenilabrus cornubicus, *Yarr.*
35 Leuciscus rutilus, *Yarr.*
Leuciscus dobula, *Yarr.*
Leuciscus phoxinus, *Yarr.*
Cobitis barbatula, *Yarr.*
Salmo salar, *Yarr.*
40 Salmo cæcifer, *Parnell.*
Osmerus eperlanus, *Yarr.*
Coregonus marænula, *Yarr.*
Alosa finta, *Yarr.*
Gadus morrhua, *Yarr.*
45 Gadus æglefinus, *Yarr.*
Merlangus vulgaris, *Yarr.*
Merlangus pollachius, *Yarr.*
Merlangus carbonarius, *Yarr.*
Merlucius vulgaris, *Yarr.*
50 Lota molva, *Yarr.*
Motella quinquecirrata, *Yarr.*
Motella glauca, (in spt.) *Yarr.*
Raniceps trifurcatus, *Parnell, Zool. Bot. Mag. Vol. I.*
Platessa limanda, *Yarr.*
55 Hippoglossus vulgaris, *Yarr.*
Rhombus maximus, *Yarr.*
Rhombus vulgaris, *Yarr.*
Rhombus hirtus, *Yarr.*
Rhombus megastoma, *Yarr.*
60 Rhombus arnoglossus, *Yarr.*
Solea pegusa, *Yarr.*
Monochirus lingula, *Yarr.*
Monochirus minutus, *Parnell.*
Cyclopterus lumpus, *Yarr.*
65 Echeneis ramosa, *Yarr.*
Anguilla acutirostris, *Yarr.*
Ammodytes tobianus, *Yarr.*
Ammodytes lancea, *Yarr.*
Syngnathus typhle, *Yarr.*
70 Scyllius canicula, *Yarr.*
Scyllium catulus, *Yarr.*
Mustelus lævis, *Yarr.*
Spinax acanthus, *Yarr.*
Squatina angelus, *Yarr.*
75 Raia batis, *Yarr.*
Raia intermedia, *Parnell.*
Raia clavata, *Yarr.*
Petromyzon marinus, *Yarr.*

The following communications were read:

1. On the Constitution of the Earth's Atmosphere in Remote Geological Epochs. By Professor Johnston, Durham.

This is the first paper of a promised series on the subject here announced. In the present paper the author endeavours to shew, that in remote epochs the atmosphere was more extensive and heavier than it is now, that it contained a greater absolute quantity of oxygen, and that this quantity has gradually diminished up to our own era, and is probably still undergoing a sensible diminution. His views are founded partly on speculative considerations, of which it is not possible to give a sufficiently circumstantial abridgment, and partly on the evidence of various operations going on at or near the surface of the earth, the tendency of which must, on the whole, apparently be to diminish the quantity and proportion of the oxygen in the atmosphere. In addition to the ordinary and well known causes of deterioration, the author points out a new source of diminution to which his attention has been lately drawn. From experiments made upon the aëriform fluid discharged from the earth during an inundation, and obviously expelled by the water penetrating to a considerable depth, and displacing the gases contained in the soil, he found that this gaseous matter consists of 2.5 per cent. carbonic acid, 12.764 oxygen, and 84.736 nitrogen. Taking this observation in conjunction with many others previously made on the composition of the gaseous discharges in volcanic districts, and the gaseous contents of mineral waters, he infers that a process of oxidation is constantly going on at various depths below the earth's surface, the oxygen for which is in all probability derived by absorption of the atmospheric gases at the surface.

2. An Account of a New Species of British Bream, and a Species of Skate new to Science; with a List of, and Observations on, the Fishes of the Frith of Forth and Neighbourhood. By Richard Parnell, M.D., F.R.S.E.

The author stated that, in July last, he obtained from the Frith of Forth a species of Bream, which he believes to be the *Pagellus acarne* of Cuvier. Length 13 inches; depth 4 inches; head one-third the length of the body not including the tail-fin. General form resembling that of the Sea Bream, but not so deep in proportion to its length. Scales large; 70 forming the lateral line, 6½ in an oblique row between it and the first ray of the dorsal-fin. Anterior-teeth small and numerous, disposed in many rows; outer row composed of 30 teeth, longer and more bent than those within; molars large, disposed in three rows in each jaw.

D 12–12, P 16, V 8, A 3–11, C. 20. Body pale silvery red. Dorsal and caudal fins rose-red; ventral and anal fins paler. Between the eyes reddish-brown; in front of the eyes and on the lower half of the preoperculum, metallic grey; on the upper part of the base of each pectoral fin, a deep violet-coloured spot, very conspicuous even in the dried state. (See Plate II.)

It differs from the *Sea Bream* in the eye being smaller, the molars much larger, and in having a dark spot at the base of the pectorals, which the *Sea Bream* never possesses.

It differs from the *Spanish Bream* in having the origin of the lateral straight, whereas in the *Spanish Bream* it is suddenly bent; in the eyes being larger; and in presenting the pectoral spot, which is never found in the other Bream.

The species of Skate, to which Dr Parnell has proposed the specific name of *intermedia*, is stated by him to be not uncommon in the Frith of Forth. Length 2 feet; body thin; snout sharp and prominent; tail rather short, with a row of spines placed on the mesial line only, not extending further up than to the base of the anal fins. Body perfectly smooth on both sides; eyes rather small, with a spine placed in front of each; teeth small, not so sharp as in the grey skate. Body above, dark olive-green; on the under-surface dark grey, with minute specks of a deeper colour. (See Plate II.)

It is distinguished from *R. batis* by the nose being longer; the first dorsal fin being more remote from the second, and the skin on the back being perfectly smooth, which in the *R. batis* is covered with small spicula and rough to the touch.

It is at once removed from the *R. Oxyrhynchus* of Montagu, by the under-surface of the body being of a dark grey-colour; which part in the *R. Oxyrhynchus* is perfectly white.

Dr Parnell mentioned the names of 123 species of fishes found in the Frith of Forth and neighbourhood, about 40 of which have been added by himself from personal observation. Three of these are new to Science and two new to Britain.

3. Notice on the Composition of the Right Prismatic Baryto Calcite, the Bicalcareo-carbonate of Baryta of Dr Thomson. By Professor Johnston, Durham.

This mineral, as described by the author about two years ago in the London and Edinburgh Philosophical Journal, presents a new and very interesting example of the principle known to crystallographers by the name of *dimorphism;* having the same chemical constitution as the well known Baryto Calcite of Brooke, but having a form belonging to an entirely different system of crystallization. In Dr Thomson's System of Mineralogy lately published, however, it is described as a mineral species before unknown, having a composition different from that of every known mineral, and is therefore distinguished by the name of the *Bicalcareo carbonate of Baryta*.

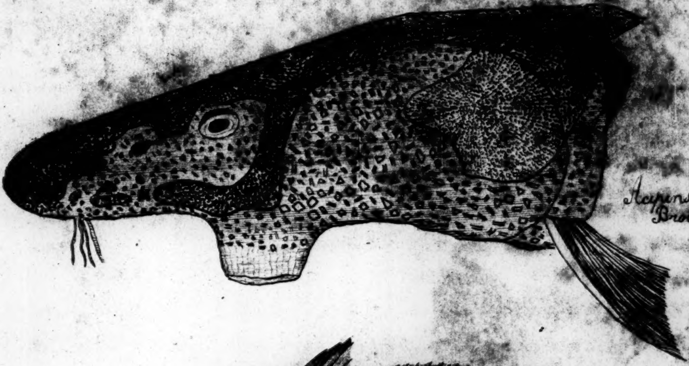
To test his former analysis, the author re-examined the mineral from the only two known localities: he analyzed also the Baryto Calcite of Brooke, and the results are embodied in the following Table:—

	Theory.	Fallafield near Hexham.	Bromley Hill, Alston.		Baryto-Calcite of Brooke.
			Johnston.	Thomson.	
Carbonic Acid..........	29.625	29.613	29.710		30.05
Carbonate of Baryta..	66.102	65.248+	62.156+		65.97
Carbonate of Lime....	33.898		30.29+		
Carbonate of Strontia.		2.87—	6.641—		2.317
	100		98.997		

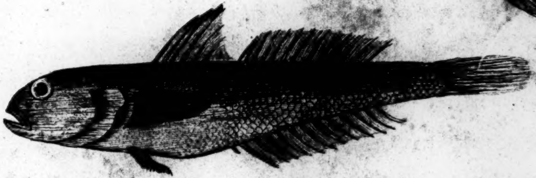
From these results the author concludes, that in describing the mineral, Dr Thomson must have been under some misapprehension in regard to its true composition, and consequently that the name he has imposed upon it must be laid aside.

4. An Explanation of the Aristotelian Expression Μετα τα Φυσικα, with some inferences from the Explanation. By the Venerable Archdeacon Williams.

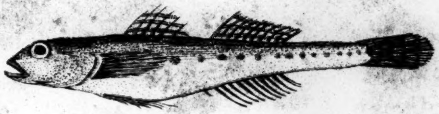
PLATE I.



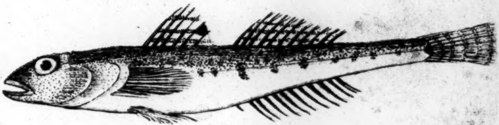
Acipenser latirostris.
Broad-nosed Sturge



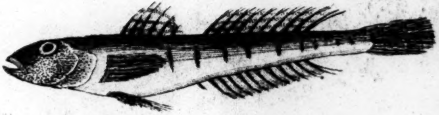
Gobius niger. Y
Black Goby.



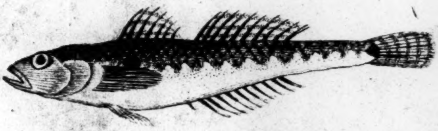
Gobius minutus. Yarr
Freckled Goby.



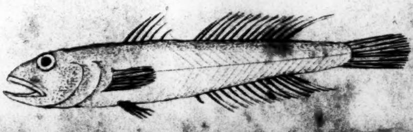
Gobius unipuncta
Onespotted Goby



Gobius gracilis Yar
Slender Goby.

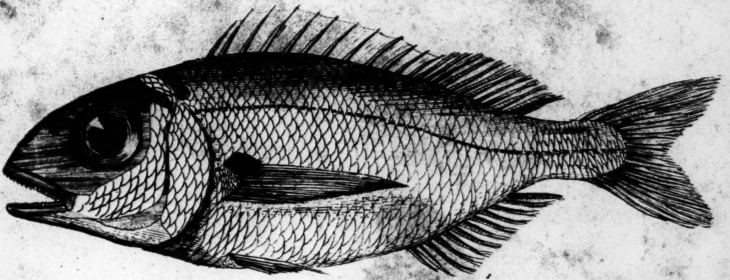


Gobius bipunctatus Y
Two spotted Goby

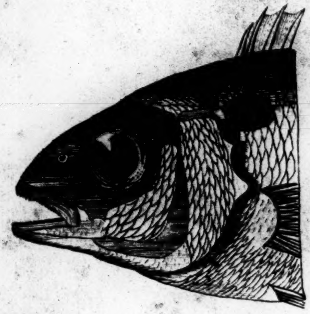


Gobius Albus. Parnell
White Goby.

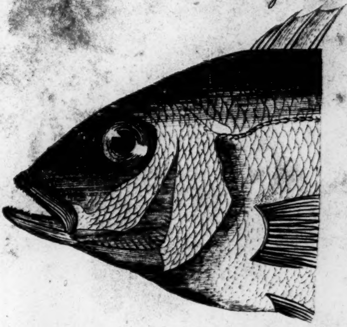
PLATE II.



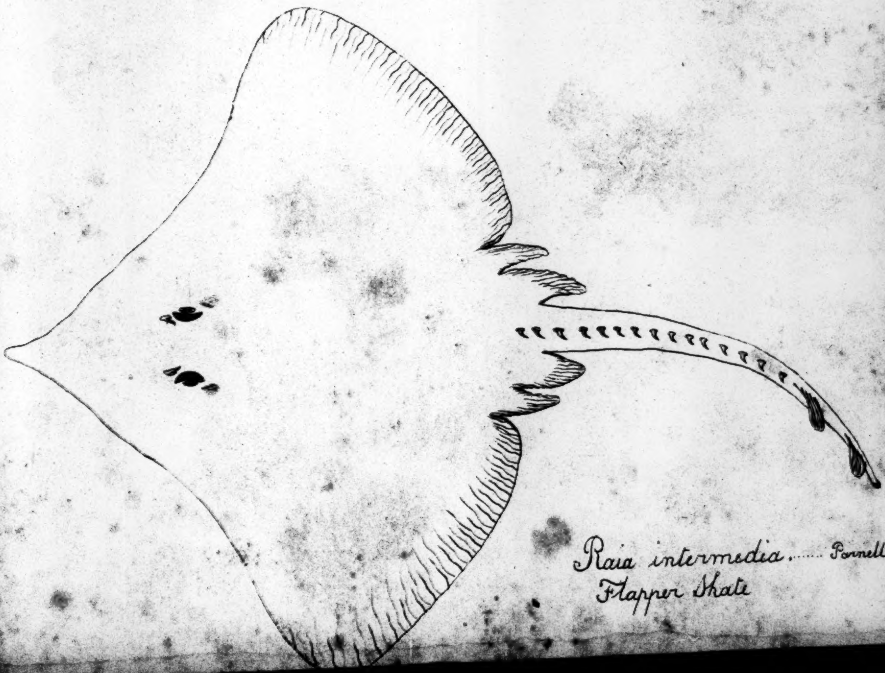
Pagellus acarne..... Cuv. t VI. p. 19
Axillary Bream.



Pagellus centrodontus. Yarrell V. I. p 107.
Sea Bream.



Pagellus erythrinus..... Cuv et Val t VI. p 170.
Spanish Bream.



Raia intermedia....... Parnell
Flapper Skate